

*Jack C. Cmt B*

a third region of the first conductivity type formed at and near the surface of said first region, and surrounding said second region;

a first electrode portion formed on the surface of said third region located between said first and second regions with an insulating film therebetween;

a second electrode portion connected to said second region;

a third electrode portion connected to said first region and spaced by a distance from said third region; and

a fourth region of the first conductivity type formed at and near the surface of said first region between said third electrode portion and said third region;

wherein, a position in depth of an interface between the first region and the fourth region changes in a direction crossing a direction of flow of the current.

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#### REMARKS

This Amendment is being filed in response to the Office Action dated August 22, 2002. For the following reasons, this Application should be allowed, and the case passed to issue.

No new matter is introduced by this amendment. The amendment to claim 1 is supported by FIG. 3 and 15 and the accompanying portions of the specification.

#### ***Claim Rejections Under 35 U.S.C. § 112***

Claim 9 is rejected under 35 U.S.C. §112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled

in the art to make and/or use the invention. This rejection is traversed, and reconsideration and withdrawal respectfully requested.

The Examiner asserts that the written description does not disclose that the fourth region is electrically connected to the second electrode portion as claimed in claim 9.

*OK, but  
not support  
claim 9*

However, claim 9 is supported by Figures 26 and 27, and the specification at page 19, lines 22-23, which states "P-type diffusion regions 7 are electrically connected together via base electrode 12 filling contact groove 18."

### ***Claim Rejections Under 35 U.S.C. § 103***

Claims 1, 3, 4, and 12 are rejected under 35 U.S.C. §103(a) as being unpatentable over Kitamura et al. (US Patent No. 5,432,370). This rejection is traversed, and reconsideration and withdrawal thereof respectfully requested. The following is a comparison between the instant invention as claimed and the cited prior art.

An aspect of the instant invention, per claim 1, is a semiconductor device with a first region of a second conductivity type formed on and in direct contact with a semiconductor substrate of a first conductivity type. The semiconductor device further comprises a fourth region of the first conductivity type formed at and near the surface of the first region between a third electrode and a third region of the first conductivity type. A position in depth of an interface between the first region and the fourth region changes in a direction crossing a direction of flow of the current.

The Examiner avers that Kitamura teaches the claimed semiconductor device and that it is well known that depletion layers form at pn junctions, therefore, there would be a depletion layer formed in the n-type region 2, which is under p-type region 4, and a depletion layer formed in portions of the n-type region 2 between portions of the p-type region. Therefore, the Examiner concludes a depletion layer would extend from the fourth region and the depletion layer would have a depth changing as a position moves in a direction crossing a direction flow of the current.

Kitamura, however, does not suggest a semiconductor device, wherein, a position in depth of an interface between the first region and the fourth region changes in a direction crossing a direction of flow of the current, as required by claim 1. As described below, the structure of the Kitamura device does not provide a semiconductor device, wherein a position in depth of an interface between the first region and the fourth region changes in a direction crossing a direction of flow of the current.

A copy of FIG. 6(a) and 6(b) of Kitamura is attached, along with a section taken along line I-I. According to Kitamura, the asserted fourth region (P) 4 is formed on a first region (N) 2, and an element isolation oxide film 5 is formed on the fourth region 4. Between isolation oxide film 5 and fourth region 4 is a region 36 that exposes first region 2. The fourth region is removed and covered by an insulating film 11 at region 36. No PN junction interface exists in region 36 along the sidewalls of fourth region 4. Thus, the position in depth of the PN junction interface between first region 2 and fourth region 4 does not change (See section I-I).

*incorrect  
sections  
view of  
fig. 6(a)*

In contrast thereto, in the present invention the discretely formed fourth region 7 has a PN junction interface between the sidewalls of the fourth region 7 and the first region 2, as

shown in FIG. 3. Therefore the position in depth of an interface between the first region 2 and the fourth region 7 changes in a direction crossing a direction of flow of the current. Moreover, in another embodiment of the invention as shown in FIG. 15, the position in depth of an interface between the first region 2 and the fourth region 7 changes in a direction crossing a direction of flow of the current, even though the fourth region 7 is formed continuously. In the embodiment shown in FIG. 15, the fourth region 7 is continuously formed with the depth of the P-type diffusion region 7 changing as a position moves in the direction crossing the direction of the current flow (page 13, lines 25-33).

There is no suggestion Kitamura to form the fourth region 4, such that a position in depth of an interface between the first region and the fourth region changes in a direction crossing a direction of flow of the current, as required by claim 1.

Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge readily available to one of ordinary skill in the art. *In re Kotzab*, 217 F.3d 1365, 1370 55 USPQ2d 1313, 1317 (Fed. Cir. 2000); *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). There is no suggestion in Kitamura to provide a semiconductor device with a position in depth of an interface between the first region and the fourth region that changes in a direction crossing a direction of flow of the current, as required by claim 1. The mere fact that references can be combined or modified does not render the resulting combination obvious unless the prior art also suggests the desirability the modification. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990).

The requisite motivation to support the ultimate legal conclusion of obviousness under 35 U.S.C. § 103 is not an abstract concept, but must stem from the applied prior art as a whole and realistically impel one having ordinary skill in the art to modify a specific reference in a specific manner to arrive at a specifically claimed invention. *In re Deuel*, 51 F.3d 1552, 34 USPQ2d 1210 (Fed. Cir. 1995); *In re Newell*, 891 F.2d 899, 13 USPQ2d 1248 (Fed. Cir. 1989). Accordingly, the Examiner is charged with the initial burden of identifying a source in the applied prior art for the requisite realistic motivation. *Smiths Industries Medical System v. Vital Signs, Inc.*, 183 F.3d 1347, 51 USPQ2d 1415 (Fed. Cir. 1999); *In re Mayne*, 104 F.3d 1339, 41 USPQ2d 1449 (Fed. Cir. 1997). There is no motivation in Kitamura for providing a semiconductor device in which a position in depth of an interface between the first region and the fourth region changes in a direction crossing a direction of flow of the current.

The only teaching of the claimed device, including a position in depth of an interface between the first region and the fourth region that changes in a direction crossing a direction of flow of the current is found in Applicant's disclosure. However, the teaching or suggestion to make a claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). The Examiner's conclusion of obviousness is not supported by any factual evidence. The Examiner's retrospective assessment of the claimed invention and use of unsupported conclusory statements are not legally sufficient to generate a case of *prima facie* obviousness. The motivation for modifying the prior art must come from the prior art and must be based on facts.

The dependent claims further distinguish the claimed invention. For example, claim 3 requires the fourth region is fixed to a constant potential. Claim 4 requires that the fourth region is electrically connected to the first electrode portion or the second electrode portion. Claim 12 requires that the fourth region is a continuous region having changing depths in a direction crossing a direction of current flow. Kitamura does not suggest the claimed semiconductor device with these additional limitations.

*Allowable Subject Matter*

Claims 7, 8, 10, 11, and 13 are allowed.

Claims 2, 5, and 6 are objected to as being dependent upon a rejected base claim but would be allowable if rewritten in independent form.

Applicant gratefully acknowledges the indication of allowable subject matter. Applicant submits that it is not necessary to place claims 2, 5, and 6 in independent form, as claim 1 is allowable as explained above.

In light of the amendment and remarks above, this application is in condition for allowance and the case should be passed to issue. If there are any question regarding this Amendment or the application in general, a telephone call to the undersigned would be appreciated to expedite the prosecution of the application.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this

paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE."

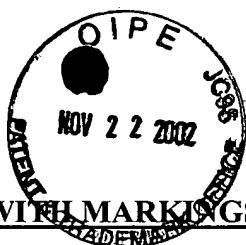
Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE IN THE CLAIMS

IN THE CLAIMS:

Claim 1 has been amended as follows:

1. (Twice Amended) A semiconductor device comprising:
  - a semiconductor substrate of a first conductivity type;
  - a first region of a second conductivity type formed on and in direct contact with said semiconductor substrate;
  - a second region of the second conductivity type formed at and near the surface of said first region;
  - a third region of the first conductivity type formed at and near the surface of said first region, and surrounding said second region;
  - a first electrode portion formed on the surface of said third region located between said first and second regions with an insulating film therebetween;
  - a second electrode portion connected to said second region;
  - a third electrode portion connected to said first region and spaced by a distance from said third region; and
  - a fourth region of the first conductivity type formed at and near the surface of said first region between said third electrode portion and said third region;
 wherein, [in an on state a depletion layer extends from said fourth region, and said depletion layer having a depth changing as a position moves in a direction crossing a direction of flow of the current] a position in depth of an interface between the first region and the fourth region changes in a direction crossing a direction of flow of the current.

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